

# CLIMESSENCES

## PROJECT

CLIMESSENCES, A SERIES OF GUIDELINES FOR CHOOSING TREE SPECIES IN THE CONTEXT OF CLIMATE CHANGE

AFORCE

## PROJECT CONTEXT AND OBJECTIVES

The ClimEssences website is the result of more than 10 years' work within the AFORCE network.

It grew out of the NOMADES project – New Methods for the Acclimatisation of Forest Tree Species – which ran from 2011 to 2013, during which numerous questions arose regarding which tree species to plant and the tools available to identify the forest of the future.

This project was followed by the CARAVANE – a comprehensive catalogue of new varieties to be trialed – from 2015 to 2019, and IKSMAPS 1 and 2 – production of pre-calculated maps showing the evolution of climatic ranges for the main tree species in French forestry using the IKS model – from 2015 to 2018. These two projects led to the launch of ClimEssences in December 2021.

The CARAVANE project arose in response to concerns about the replacement of native tree species by non-native ones. The aim was to bring together all available information on these species, both current and future, in the context of climate change.

The IKSMAPS project stems from the IKS climate compatibility model developed by Mr Hervé le Bouler (2011) as part of the NOMADE project and subsequently further developed by the ONF's RDI department. The aim was to create a practical tool for assessing the climate compatibility of species with possible future climates using a limiting-factors approach.

Bringing these projects together, the tool has taken shape as a fully functional website.

## PROJECT CONTENT

TECHNICAL  
DOCUMENT

SCIENTIFIC  
REPORT

✓ OPERATIONAL  
TOOL

✓ RESEARCH  
TOOL

The ClimEssences tool (Fig. 1) is divided into two sections:

### I - IKSMAPS Section

- Climatic variables
- Climatic Analogy
- Climatic compatibility

### II - CARAVANE Section

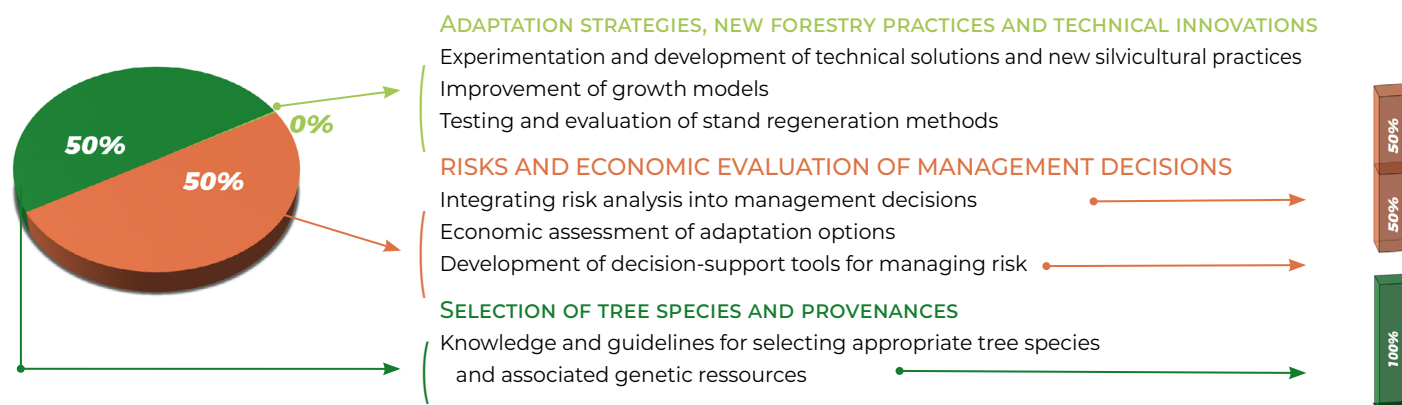
- Species fact sheets
- Species comparison for all criteria
- Comparison for a selection of criteria



Figure 1: Overview of the ClimEssences website homepage and the various modules.

The tool comprises a standard mode (discussed here) and an expert mode, which is available following.

## THE PROJECT'S CONTRIBUTION TO AFORCE'S THEMES



## PROJECT PARTNERS

## IKSMAPS

### Indicators

#### ● DHYa

Drought-induced limitation

#### ● TMIa

Winter cold-induced limitation

#### ● SDJa

Heat deficiency-induced limitation

### Times Horizons

Current (1979-2013)  
2050 (2041, 2060)  
2070 (2041, 2060)

### IPCC scenarios 5

Average RCP 4.5 (optimistic scenario)  
Average RCP 8.5 (intermediate scenario)  
High-end RCP 8.5 (pessimistic scenario)

Annual and monthly climate indicators and data can be viewed in the 'Climate Variables' tab (Fig. 2).

In this tab, it is also possible to create ombrothermic diagrams (scale 1T=2P) and to add DHYa to them (Fig 3).

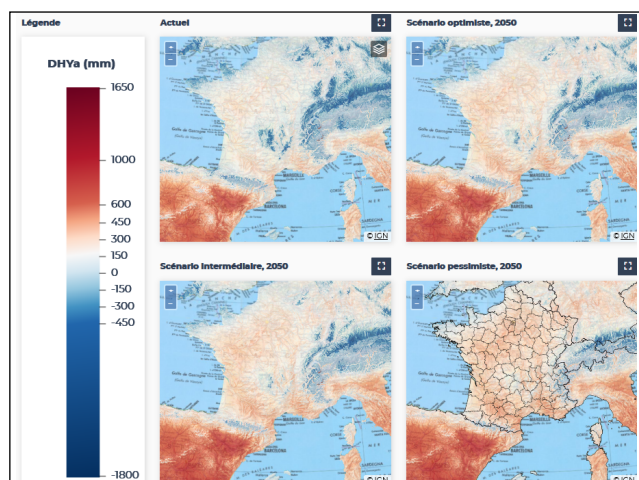


Figure 2: Presentation of the DHYa indicator for the current period and the 2050 period, based on the three IPCC scenarios.



Figure 3: Presentation of the ombrothermic diagram for a set of coordinates, showing DHYa projections up to 2050.

## Climate analogy

Using the IKS criteria, it is possible to characterise the future climate (climate cube) of an area, at the levels of the sylvo-ecoregion or the forest region. Based on this result, the climate analogy identifies the areas that currently have a climate similar to the future climate of the area of interest (Fig. 4).

## Climate Compatibility

Data on species occurrence were collected through the European national forestry institutes.

Thresholds were set for each IKS indicator at 97.5 per cent (yellow) and 99 per cent (red) of the species' occurrence points (excluding outliers).

**A species is within its climate suitability range when all thresholds are met (Fig. 5).**

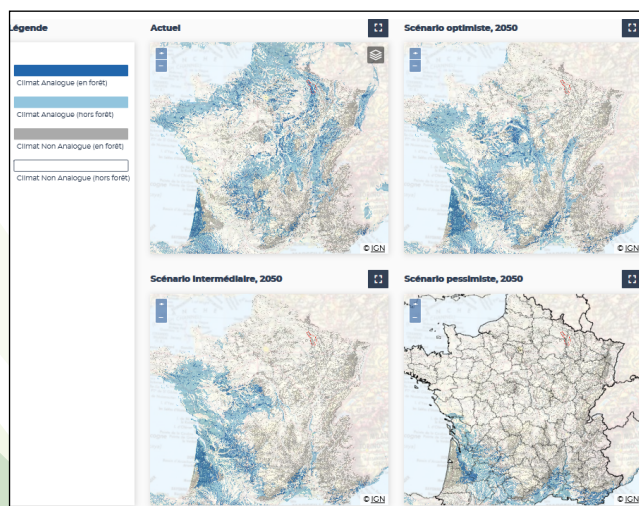


Figure 4: Example of a climate analogy for the Argonne region for the 2050 horizon, based on the current trajectory and the three IPCC scenarios.

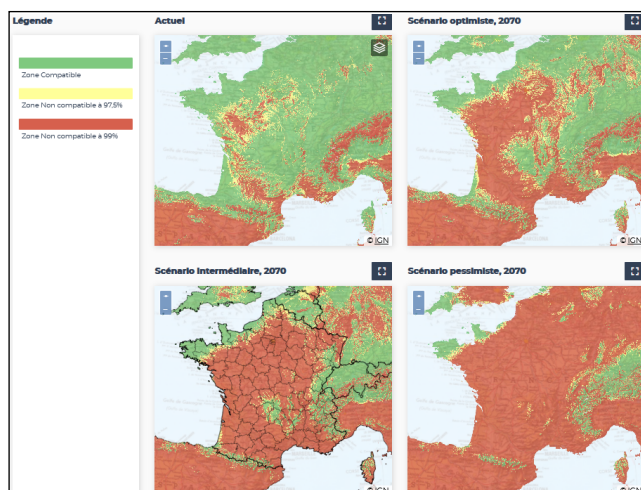


Figure 5: Example of climate compatibility for Abies alba by 2070, based on the current baseline and the three IPCC scenarios.

## Species fact sheets

Ultimately, 237 tree species will be described, with an equal split between conifers and broad-leaved trees.

### Species overview

Name, Photos, Appearance, Location, Range (Fig. 6).

### 37 criteria under 8 themes (Fig. 7)

Climatic limiting factors  
Soil-related limiting factors  
Knowledge of genetic diversity  
Growth and timber production

Other ecosystem services  
Silvicultural management  
Vulnerability to biotic risks  
Vulnerability to abiotic risks



Figure 7: Presentation of a criterion from the 'Climatic limiting factors' theme for *Sorbus aria*.

### For each criterion:

A summary text; A rating for the criterion ranging from A (excellent) to D (poor) with the designation I where this value is unknown; A rating of the reliability of the information (from low to good); The extent of the sources used: field data and expert opinion (ranging from scarce to abundant) and a breakdown of the number of references; a soil acidity/moisture ecogram; a map showing the locations of R&D sites in France (arboretums, experimental plots or atypical stands).

### Recommendations (Fig. 8)

#### Conclusions on the species

Espèce rustique mais que la concurrence confine souvent à des stations contraignantes. Résiste bien à la sécheresse donc potentiellement intéressante en cas de changement climatique. Souvent gérée en taillis ou comme des feuillus précieux. Peu de débouchés pour le bois mais intérêt ornemental, pour la biodiversité ainsi que pour limiter l'érosion des sols. Très sensible à la dent du gibier.

Figure 8: Recommendations for *Sorbus aria*.

## Species comparisons and comparisons based on selected criteria

It is possible to select up to 5 criteria (filter criteria, rating filters, minimum compatibility and unknown value filter) to identify the species that best meet the selection criteria (Fig. 10).

Furthermore, it is possible to compare up to 5 species against all criteria (Fig. 11).



Figure 10: Presentation of two of the species (*Sorbus aria* and *Ginkgo biloba*) meeting the three selected criteria.

### A Bibliography (Fig. 9)

#### List of references used for this fact sheet

**Bibliographie**

- 1 Rameau, J.-C.; Mansion, D.; Dumé, G. – Flore forestière française – Tome 1, plaines et collines – IDF: 1989.
- 2 <http://www.lucnredlist.org>
- 3 Welk, E., de Rigo, D. and Caudullo, G. 2016. *Sorbus aria* in Europe: distribution, habitat, usage and threats. In: San-Miguel-Ayza, J., de Rigo, D., Caudullo, G., Houston Durrant, T., Mauri, A. (ed.), European Atlas of Forest Tree Species, Publications Office of the European Union, Luxembourg.

Figure 9: Presentation of part of the bibliography used for the *Sorbus aria* species fact sheet.



Figure 11: Presentation of one of the comparison criteria between three species of the genus *Sorbus*.

## KEY LESSONS

The IKS model is a climate suitability model.

It does not take into account many limiting factors (soil, biotic risks, etc.).

The resolution is at the kilometre level and is not suitable for analyses at plot level.

Finally, the boundaries of the suitability areas should not be interpreted too literally.

The species fact sheets provide information in an easily accessible format, which facilitates comparisons. They are constantly evolving and depend on advances in knowledge.

These two complementary tools provide a range of guidance on the selection of tree species in the context of climate change.

## TARGET AUDIENCE AND PROJECT OBJECTIVES

Difficulty in appropriation:



LOW



MEDIUM



HIGH

This objective does not apply to this audience: ○

| OBJECTIVE<br>TARGET AUDIENCE           | Management<br>Tools and recommendations | Research and development<br>Tools and content creation | Education<br>Knowledge acquisition |
|----------------------------------------|-----------------------------------------|--------------------------------------------------------|------------------------------------|
| Forest owners                          | ●                                       | ○                                                      | ●                                  |
| Technical forestry staff               | ●                                       | ○                                                      | ●                                  |
| Research and development practitioners | ○                                       | ●                                                      | ●                                  |
| Higher education students              | ○                                       | ●                                                      | ●                                  |
| Technical education Students           | ●                                       | ○                                                      | ●                                  |

ClimEssences has been designed and developed to assist **all professionals** (forestry advisers, landowners, forest managers, nursery operators, etc.) as well as **anyone with an interest in the subject**.

## TEAM

The coordinators of the ClimEssences project are Mr Eric Paillassa (CNPFF-IDF), Mr Alexandre Piboule (ONF-RDI) and Ms Brigitte Musch (ONF-RDI).

The coordinator of the NOMADES project is Mr Hervé Le Bouler (CNBF).  
The coordinator of the CARAVANE project is Ms Brigitte Musch (ONF-RDI).  
The coordinator for the IKSMAPS 1 and 2 projects is Ms Myriam Legay (ONF-RDI).

## FOR MORE INFORMATION

The ClimEssences website is available at: <https://climessences.fr/> and further information on the various modules can be found in the 'Documentation' section.

To undertake expert-level training, please contact the RMT AFORCE coordinator or send a message via the « [Contact](#) » ClimEssences website.

Further information can be found on the dedicated pages of the RMT AFORCE:

- [The NOMADES project](#);
- [The CARAVANE project](#);
- [The IKSMAPS 1 project](#);
- [The IKSMAPS 2 project](#).

## PROJECT FUNDERS